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FRIDAY, AUGUST 2, 1895.

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American Journal of Science.

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THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

IN a few weeks the American Association for the Advancement of Science will begin its annual session, in the city of Springfield, Massachusetts. It is now fifteen years since the Association met in New England, during which time its meetings have been held in various parts of the country, including points as widely separated as Minneapolis in the Northwest and Washington in the Southeast.

The meeting of 1880 was held in Boston and, up to the present time, is distinguished from all others, either earlier or later, by the large attendance, the great local interest manifested and the importance of the papers presented. The meeting at Philadelphia, in 1884, was, perhaps, the closest approximation to the Boston meeting as far as concerns these points, but the latter must still be regarded as the high-water mark in the history of the Association.

It is unnecessary, in these columns, to refer to the history of this Society, as it is, doubtless, very well known to most of our readers. The first meeting was held in the year 1848, in the city of Philadelphia; the organization then accomplished growing,

however, out of another, namely, the Association of American Geologists and Naturalists, which had preceded it by a few years. From that year up to the present, with the exception of a period during the Civil War, regular annual sessions have been held, and, indeed, for a time two meetings a year were thought necessary to enable the Society to do its work.

At the meeting at Newport, in 1860, it was agreed that the next meeting, that of 1861, should be held at Nashville, Tenn. However, the course of events, not only as relating to this organization, but to all others, was subjected to extreme modification by the breaking out of the Civil War in the spring of 1861, resulting in the suspension of the meetings of the Association until 1866, when it again resumed its work, holding its first session of the new series in Buffalo, N. Y. The number of members has grown constantly from the beginning, until for several years it has considerably exceeded two thousand.

It is also unnecessary to refer at length to the great importance of the existence of this Association to the scientific interests of the country. Through it students of the various departments of science have been annually brought together, resulting not only in the increase and diffusion of knowledge, but in the cultivation of a fraternal spirit among men working along the same lines, that has had much to do with the great advances that have taken place during the past quarter of a century.

The Society has been from the beginning very largely popular in its character. It has not attempted to restrict its membership by the establishment of conditions as to professional attainments or knowledge, but, on the contrary, has been fairly open to all who have any desire to be actively interested in the advancement of science. The wisdom of this course cannot be denied, and it has been followed, as is well known, in other countries with equally satisfactory results. It is true that the Society has been at times by some persons rather severely criticised for the liberality with which it welcomes all who desire to become members, and especially for the rather liberal way in which contributions in the way of papers have been received and treated by its controlling committees; but it is believed that a more careful examination of the actual results of this course will prove that, on the whole, it has been a wise one. Scientific men sometimes forget that it is necessary for them to have a constituency, without which it would be impossible for even the most accomplished to enjoy the opportunities and facilities which are necessary for the successful prosecution of their work. It is not even necessary that this constituency should in all cases understand the nature of the work on which the scientific man is engaged, but it *is* necessary that, in some way, it should be interested in that work and that it should be convinced that, although not understood, it is of value to the human race, either present or prospective. There are Societies in this country, as well as elsewhere, which are organized solely for the benefit of those who are engaged in scientific investigation and research. They have little in their transactions of interest to the general intelligent public, and it is entirely proper that they should exist for the purpose of encouraging and discriminating among those who

devote their lives in a greater or less degree to original investigation. But it cannot be denied that such a Society as the American Society for the Advancement of Science is, after all, of greater value than these, in that it furnishes the channel of communication between the purely abstract scientific work of the very limited number who by nature and occupation can engage in such work and the great intelligent public upon whom such men must, after all, depend for their support and final appreciation.

It has been noted with considerable regret, during the past ten or fifteen years, that a number of the more prominent men of science in the United States have not actively interested themselves in the affairs of the Association. There are several reasons that have been adduced for this, not the least of which is the inconvenience of attending its annual meetings occurring, as they do, during that part of the year which the majority of scientific men have set aside for purposes of recreation and rest. By a small number it has also been objected that the Association has not been and is not maintained in a way to satisfy their desires, in that it has not been sufficiently exclusive in the matter of membership and in the matter of papers which it has permitted to be read and discussed at its meetings. The last excuse for a lack of interest in this work has already been commented upon, and has its origin in a failure to understand the real objects of the Association, and also in a failure to understand the real relation that ought to and in a great degree must always exists between the scientific world and the general intelligent public. The difficulty of attending its meetings is usually greater for many of those who are quite constant and regular in their attendance than for many others who are much less so. An examination of the list of those present at the various meetings during the past decade will show that New England has fallen very far short of furnishing her quota of membership. One might naturally expect, owing to the large number of institutions of learning, of a high grade, of scientific and technical institutions, and of scientific men independently engaged in original research found within the borders of New England, that her influence would be paramount in the direction and management of the American Association for the Advancement of Science, and so it might be if New England cared to have it so. Some of those who occasionally indulge in criticism upon the conduct of the Association have little excuse for so doing, because they rarely, if ever, attend its meetings, and, therefore, never attempt to direct or control their management. Indeed, it may justly be said that those who have criticised the methods of the Association most frequently and most severely might easily have made it whatever they wanted it to be if they had cared to take enough interest to attend its meetings and use their influence in directing its affairs. The meeting at Springfield will afford an opportunity rather rare for members of the Society both in the East and in the West. Western members will be glad to attend this meeting, because it will bring them within reaching distance of a large number of schools, scientific laboratories, institutions of learning and others which they occasionally like to visit and inspect

and which they can well see before or after the regular session of the Association. Those residents of New England who are members of the Association and those who ought to be members of it cannot, this year, have the excuse of inconvenience and difficulty in attending its meetings. The place of meeting is so convenient that in many cases only an hour or two at most will be required to reach it, and certainly this expenditure of time and energy, even in August, ought not to stand in the way of such attendance. Indeed, New England members should not forget that a very large number of their colleagues in this Association travel several hundreds, and a considerable number of them several thousands, of miles in order to attend its meetings, and it ought to be a matter of pride with them to furnish a respectable quota of membership when the distance is comparatively trifling. In short, it is greatly to be hoped that New England colleges and New England institutions of learning of all classes will furnish a large contribution to the membership of the Association at the meeting in Springfield. It is anticipated that a very large number of members will be present from the West and South, and as the meeting will be distinctively a New England meeting, it is sincerely hoped that New England may be largely and ably represented in the membership.

Very considerable preparations have been made locally for the reception and entertainment of the Association. A number of excursions have been planned, which will be of great interest to those who are interested in different departments of natural science, and, altogether, the preparations for the meeting are quite as forward and promising as ever before in the history of the Association.

It is particularly desired that a large number of good papers shall be ready for the consideration of the committee before the opening of the meeting. The Vice-Presidents of several of the sections have already indicated their wish that papers might be prepared in advance and forwarded to the committee, that they might be considered and reported upon so as to be put upon the programme early, and they desire that those who are contemplating the presentation of papers at this meeting should act upon this suggestion and forward to their address, that is, the address of the Vice-Presidents shown in the circular of information, as early as possible, a list of titles and subjects for discussion, which will be submitted to the committees for recommendation. Special effort has been made, and a special desire has been expressed by the Vice-Presidents of the sections relating to mathematics, physics, chemistry and mechanics. There are doubtless many persons interested in these subjects who have material which would be of great interest to the Association and which they have contemplated presenting on the occasion of the meeting. From all such these officers hope to receive titles as early as possible, and from others who may possibly be prevented from attending the meeting they would be very glad to receive papers for presentation, which may be read by other members of the section after approval by the proper committee. It is especially to be remembered that membership in the Association is not a necessary preliminary to the presentation

and acceptance of papers. The privilege of reading before any of the sections will be undoubtedly secured to any author of an accepted paper, his election to membership being almost certain to follow the approval of a paper by the sectional committee.

It will be noted by those interested that the meeting of the Association has been put at a somewhat later date this year than usual, the object being to bring it as nearly as may be just before the opening of the fall terms in colleges and other institutions of learning. This change was made after much consideration of the inconvenience to which reference has been made above, arising out of the fact that the meeting of the Association broke into the annual vacation of many of its members. By putting the date a week later, it is believed that the meeting will be found to come more nearly at the end of the vacation for the great majority of its members and that they will, therefore, find it convenient to be present at its meetings after having enjoyed the rest and recreation for which they have arranged during the summer months, and will be able to proceed directly from the meeting of the Association to begin the work of the year.

The British Association for the Advancement of Science has long been the great scientific event of the year in England; its meetings are generally attended by not only the very ablest and the most distinguished men of science in England, but by all ranks of those engaged in scientific investigation, those engaged in teaching science and many hundreds, if not thousands, of those who have only a general interest in the advancement of science. By reason of this very general and very united effort on the part of all of these various classes, the British Association for the Advancement of Science has long been a power in Great Britain, and to it may be attributed more than to any other organization the wide interest in and generous support of scientific research which is to be found there in a degree greater than in any other country in the world. The American Association for the Advancement of Science should sustain in this country the same relation to the progress of science as that of the British Association in England, and in a great degree it already does; but it must be admitted by all that it falls short of reaching the high degree of efficiency of which such an organization is capable, and it is to be hoped that this state of affairs may be remedied in the near future by the hearty and earnest coöperation, in the support of the Association, of all classes of men engaged in scientific pursuits or interested in the progress of science.

A ROCK FISSURE.

IN the autumn of 1891 the work of the U. S. Geological Survey led me across the Colorado plateau in northern Arizona. Canyon Diablo is a gorge about as broad and deep as the gorge of Niagara, 40 or 50 miles in length, running northward and ending at the Little Colorado River. One day I followed its east wall to the mouth, and then turning westward on the road toward Flagstaff, rode six or eight miles to the McMillan place, where a rude cabin constitutes the headquarters of a sheep ranch. Drinking water for the 'sheep herders' (occidental for shepherds) is obtained from a natural well close by, which

is nothing more nor less than a crack in the rock. The plateau is there constituted of limestone, the Aubrey limestone of the Carboniferous system. The rock is traversed by great faults and flexures, chiefly of the limestone yields less readily to erosive agents than the soft overlying shale. The crack referred to traverses one of the limestone blocks for a distance of 800 or 1000 feet, and ends abruptly against a fault, as

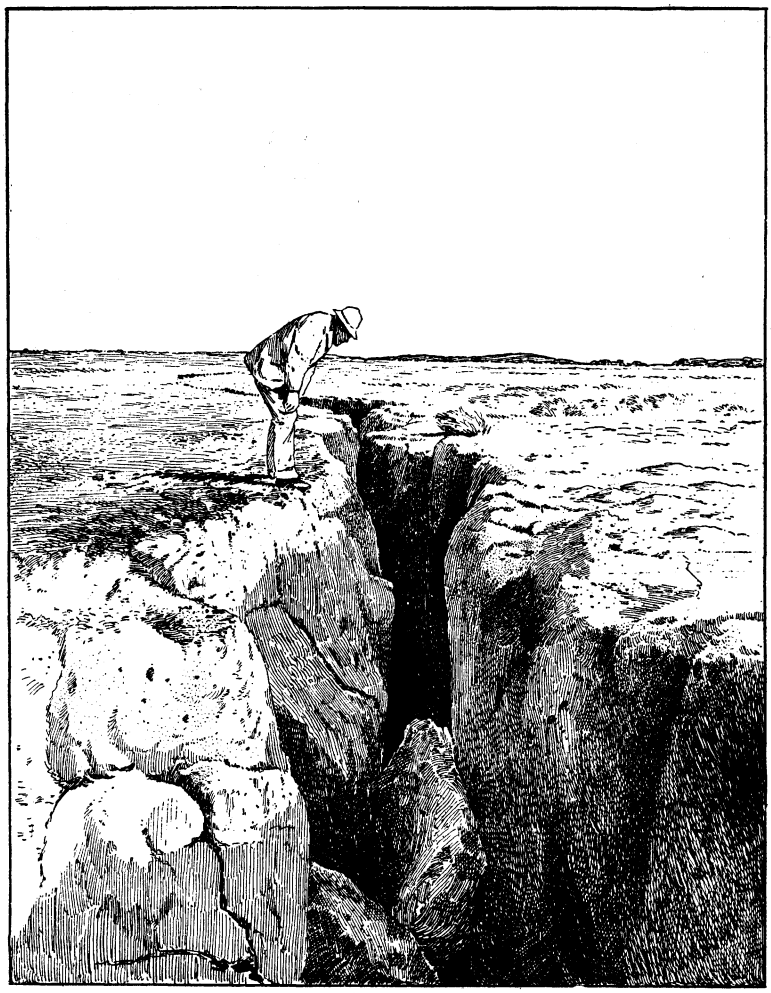

Fig. 1. View of rock fissure, drawn from photograph.

middle Tertiary date, and since these were formed the region has been extensively degraded. In the immediate vicinity of the ranch are several small faults, from 10 to 50 feet in throw, and these are clearly expressed in the topography, not, I think, because they are freshly formed, but because indicated diagrammatically in figure 2. It is there 6 or 8 feet wide, and it tapers gradually to the other end. In the downward direction it is said to taper also, the width diminishing from 4 or 5 feet to about one foot in 100 feet of descent, at the point where water is drawn. The water, which

is reached at 95 feet from the surface, is probably in motion, as its excellent quality is said not to have been disturbed by the addition of a dozen or so sheep which accidentally fell into the fissure. This last point I could not investigate as the windlass was not in operation at the time of my visit. The occupant of the cabin told me of other cracks of the same character about fifty miles to the northward, and said that one of them was considerably broader and contained cliff houses.

Very little surface water finds its way into the fissure. As shown in the view (Fig. 1) the edge has lost some of its original angularity through weathering, and details of surface which the view does not represent show that waste has been chiefly through solution. The small amount of this waste, and the fact that the fissure is not clogged above the water level by débris, show that it is very young from the geologic point of view, although in years or centuries it may be venerable.

The relation of this deep crevice to a fault and its disassociation from all lines of surface drainage show that it is not a canyon carved by running water, and I see no possibility of avoiding the inference that it is a crack resulting from tension of the rock. Such cracks must be formed at the surface wherever brittle rocks are bent in anticlinal arches, but so far as my reading goes, the

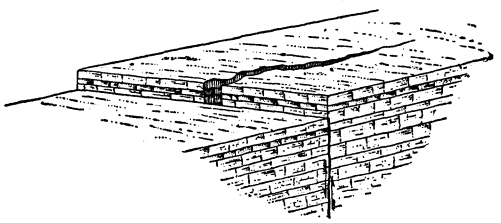

Fig. 2. Diagram showing relation of rock fissure to fault.

record of them is rare. Popular, and for that matter geologic, literature does indeed contain many allusions to fissures that are assumed to be diastrophic, but such allusions are usually based on misinterpretation, the fissures being really canyons of erosion. Whymper, in his 'Travels amongst the Great Andes' (pp. 108, 219, 220), describes a number of 'earthquake quebradas' which seem to be true fissures, and tradition makes them recent, the date 1868 being assigned to one of them. I am not aware that any have been previously described from North America excepting, on the one hand, cracks in alluvium produced by earthquakes, and, on the other, rock fissures partly or wholly filled by vein matter and afterward denuded.

The reader who wishes to visit the locality should leave the Atlantic and Pacific railway at either Winslow or Canyon Diablo and secure private conveyance.

JULY 18, 1895. G. K. GILBERT.

THE METRIC SYSTEM IN ENGLAND.

ON the 13th of February last, a select Committee of the House of Commons was appointed 'to inquire whether any and what changes in the present system of Weights and Measures should be adopted.'

There were seventeen members of the committee, including Sir Henry Roscoe, Mr. Justin McCarthy, Sir Albert Rollet, Mr. Charles Fenwick and others, some of whom were known to be in favor of a change, and others equally well known to be opposed to any essential modification of the existing system. The Committee had power to send for Persons, Papers and Records. In all fourteen sessions of the Committee were held, the first being on February 19th and the last on June 27th. During this period many witnesses were examined representing many different interests, including official, commercial, manufacturing, trade, educational and professional. On July 1st the Committee made a Report to the House of Commons, the essential features of whieh received the

approval of every member of the Committee but one. Some of the conclusions reached are extremely interesting and important. It was found that "with a single exception, all the witnesses express a strong opinion as to the complicated and unsatisfactory condition of our present weights and measures, and of the distinct and serious drawback to our commerce, especially our foreign trade, which this system entails, differing as it does from the system (metrical) now adopted by every European nation excepting ourselves and Russia, as well as by far the majority of non-European countries with which this kingdom trades. The evidence, however, goes further to show that not only is our foreign trade, in every branch, seriously handicapped, but that the home trade would be benefited if more simple and uniform standards of weights and measures than those now existing were adopted."

On the question of loss of time during the educational period of English due to the complicated and cumbersome system "it was stated that no less than one year's school time would be saved if the metrical system were taught in place of that now in use." Evidence was also produced to show that the change from the present to the metric system could be accomplished without serious opposition or inconvenience.

The Committee finally recommended as follows:

(a) That the metrical system of weights and measures be at once legalized for all purposes.

(b) That after a lapse of two years the metrical system be rendered compulsory by Act of Parlirment.

(c) That the metrical system of weights and measures be taught in all public elementary schools as a necessary and integral part of arithmetic, and that decimals be introduced at an earlier period of the school curriculum than is the case at present.

A Parliamentary report so positively favorable as this marks an epoch in the history of metrology. Hitherto the well known conservatism of the English has prevented action friendly to the metric system, although many famous Englishmen have been consistent and aggressive advocates of its adoption. The time has come, however, when the most sensitive nerve in the British body politic is touched by this persistent adherence to an unscientific, unpractical and uneconomical system of conducting barter. The manufacturing and commercial interests have learned within the past decade that they are handicapped by this in the markets of the world. When this fact is fully impressed upon the English people there will be prompt and decisive action.

The event ought to be a warning to the United States. It cannot be denied that a decided advantage will accrue to whichever of the two great English-speaking nations shall first put itself in line with the rest of the world in this, one of the greatest economic reforms of the nineteenth century. Up to the present time, we have been, on the whole, in advance of England, We made the system permissive in 1866, and have encouraged its use by fragmentary legislation since that time. But unless we mean to be left behind, we must shortly do something in the way of a definite plan for the complete adoption of the system. The advantages of the metric system should be vigorously exploited and kept continually before the public during the next year or two.

The recent success in England is largely due to the perfect organization and skilful direction of 'The New Decimal Association,' of which Mr. Edward Johnston is the efficient Secretary. This body took the initiative in the presentation of the advantages of the metric system and has carried on an extensive and successful educational campaign.

T. C. M.

THE 'BALL AND NOZZLE' PHENOMENON.

THE interest which has been recently shown in the phenomena of the 'ball and nozzle' must be the excuse for the present publication of some experiments which were made and described about eighteen years ago, while a sophomore at college. At that time I was of course ignorant of Bernoulli's well known theoretical conclusion that in such cases the pressure is always least where the velocity is greatest. The experiments with the water surface could be so modified as to be shown in a projection lantern. I have preferred to print the text and figures without alteration.

WILLIAM HALLOCK.

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IT is an apparently inexplicable fact that if we take two cards as A B and C D, Fig. 1, and through the middle of the lower C D, bring a tube G, as shown in Fig. 1, A B being held about one-fourth of an inch from C D by four tacks, or some such means, that if a current of air is set in motion through G, no matter how slight, or how strong, A B, instead of being immediately blown up and carried away upon the current, retains its position and is even drawn down closer to C D and held there by a force directly in proportion to the velocity of the current in G. Even a quick, strong puff can not remove it, and, in fact, we can in no way remove A B from over C D by blowing through the tube G.

The explanation of this fact seems to consist of two parts: First, why A B is not blown off as soon as a current starts in G and before any eddies, or whirlpools could be formed between A B and C D. Second, what currents are formed between A B and C D, and what action of theirs holds A B over C D. The first of these two actions is that of the first instant, the second is that of the subsequent time until the current in G ceases. During the first instant we have the current from G pressing upon a small circle of A B directly over the mouth of G. This surface is represented as included between E and F, Fig. 1. Hence all the force tending to raise the card is applied to the surface E F and by the very compressible and yielding column of air from G. The resisting forces which tend to hold the card down are its weight and inertia applied over its whole surface, and add to these two the fact that, in order to raise A B suddenly by pressure over E F, we must either lift all the air above A B along with it, thus rarefying the air between A B and C D, or we must compel the air just above A B to rush around it; even if the air G should fill the space left under A B as it is lifted up, still we should have to overcome the weight and inertia of a large quantity of air. Thus upon comparing the conflicting forces at work upon the card A B we find only the slight force of the current upon E F tending to raise A B resisted by the weight and inertia of A B and also the weight or inertia, or both, of a large quantity of air; and it would seem quite reasonable that the latter should prevail. The brevity of the time and the delicacy of the forces make experimenting very difficult.

In experimenting to confirm the theory of this first action, the lifting force applied at E F remained constant, and the resisting forces were lessened by reducing the size of the card, since by so doing its weight and inertia were lessened, and also the amount of air set in motion. Making A B smaller and smaller, a size is finally reached when A B would be lifted off by the first puff, but if held a second or two until the currents are all started it stays on of itself, *i. e.*, the lifting force at E F is now able to overcome the above mentioned resisting forces; this inferior limit to the size of A B is shown in Fig. 2. If we pass below this limit, as Fig. 3, A B will be

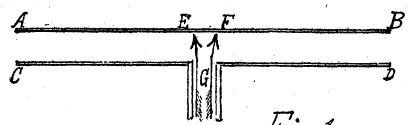

Fig. 1.

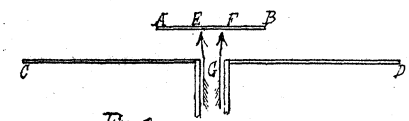

Fig. 2.

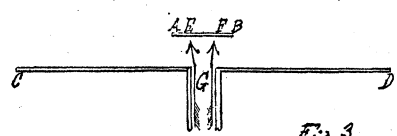

Fig. 3.

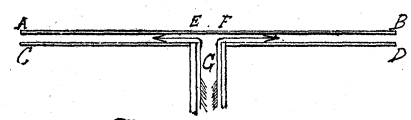

Fig. 4.

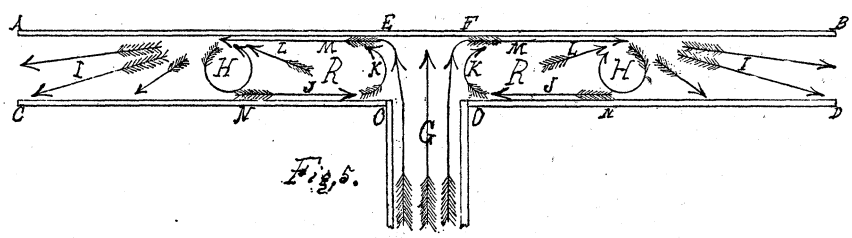

Fig. 5.

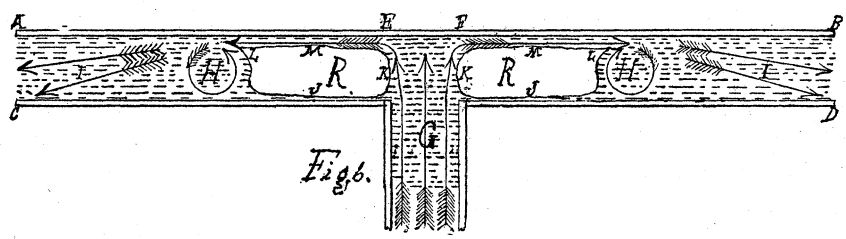

Fig. 6.

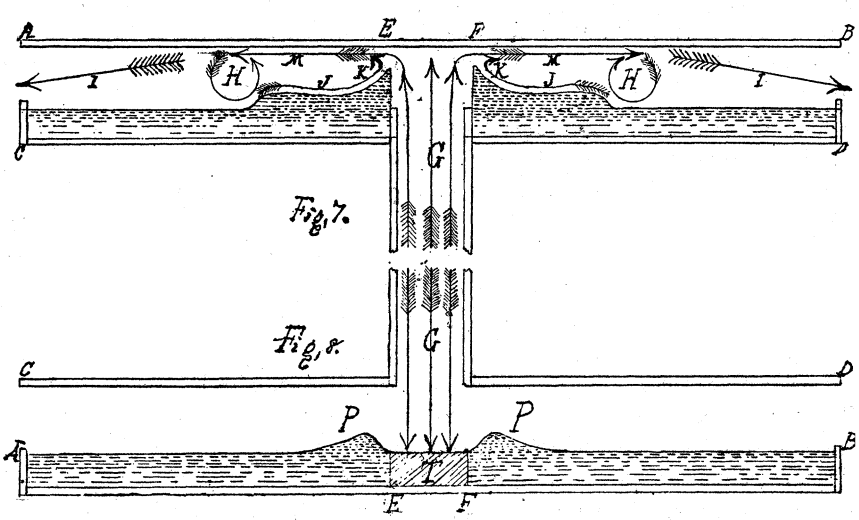

Fig. 7.

Fig. 8.

blown off every time. The size of A B, Figs. 2 and 3, varies as the square of the radius of G, and as the distance of A B from C D.

This seems a sufficient confirmation of the theory of the action of the first instant of time.

The subsequent action can be explained as follows: Fig. 5. The current from G, rising strikes A B on E F and spreads out in a direction M, passing on along M at some point H, the current M forms a whirlpool H and spreads, taking most or all of the air beyond H slowly along with it, out from between A B and C D. The currents G and M gradually attract and draw with themselves a part of the dead air in R and form a current K. The tendency of a current is to draw into, and along with itself, the adjoining dead fluid through which it flows. M and H thus drawing the air from R start a current L, which gradually draws out air from R, thus causing a slight vacuum directly over O N, and the pressure of the atmosphere on O N tends to press the two cards together to fill the space R. C D cannot rise, being fast to the tube, so A B is bent down until the space between F and O is just sufficient for the air from G to pass out through, *i. e.*, when A B and C D are separated by a distance equal to one-half the radius of G. This is shown in Fig. 4. The instant this limit is reached the action of Fig. 5 is replaced by that of Fig. 4, and the card by its own elasticity and the pressure over G rises and the action of Fig. 5 is restored. Thus in almost all cases the card vibrates rapidly. The experiments to confirm this theory were made almost entirely with water, since the results and actions would be the same and it was more convenient. The apparatus used consisted of a piece of thin board with four upright wires near the corners, upon which slid a second board; this was so arranged in order that the distance from A B to C D could be varied at pleasure. Instead of introducing the tube G through the middle of the board C D, it was placed in the middle of one of its sides, and over this edge was placed a plate of glass. This arrangement was to obtain a view of the currents in a section through the center of G and perpendicular to A B and C D. Placing this apparatus in a tub of water, with the plate of glass parallel and near to the surface, and pouring muddy or colored water through G, the currents take the directions represented by the arrows in Fig. 5. To further test the action of the currents M and H in drawing the water from R, a bubble of air was introduced in front of G before the current started, and on starting the current in G the bubble separated and each half assumed the shape shown in Fig. 6, R R, and the air was rapidly drawn out in little bubbles at L, and driven out in a direction I. To confirm the theory that the force which holds the cards together is applied at O N of the bottom card, and in order to find where the currents increased and where they diminished the pressure of the atmosphere, a surface of water was substituted for the lower card, and, again obtaining a sectional view with the plate of glass, it was found that the surface of the water assumed a shape whose section is shown in Fig. 7; thus proving very conclusively that the pressure of the atmosphere upon the surface of the water was diminished to some little extent by the currents M and H, and that here we have the whole cause of the apparently strange action of the card. On substituting a surface of water for the upper card A B, a section shown in Fig. 8 was obtained; thus showing that the only effect of the currents upon A B is the pressure at E F. These four experiments, Fig. 5, with colored water and Figs. 6, 7 and 8, seem to sufficiently establish the above theory of the cause of the card being drawn down after the first instant. The theories of the action at the be-

ginning and during the continuance of the current from G being established, and as the whole action is comprehended in these two periods of time, this apparently inexplicable fact would seem to be explained.

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*THE PRESENT PROBLEMS OF ORGANIC EVOLUTION.**

At the outset of a conference on the subject of evolution, it is necessary that we understand what we mean by the term. Evolution is creation by energy which is intrinsic in matter, and is not creation by energy exclusively without the evolving matter. Those who explain creation by interference from an external creative power are not therefore evolutionists. This view of creation is opposed to the natural tendency to account for phenomena not otherwise explainable, by an appeal to a supernatural cause. If we desire to know the truth, however, in this or any other matter, it is necessary to divest ourselves of prepossessions and preferences, and rely exclusively on the evidence. But the result of this method in the case of organic evolution is to demonstrate, in my opinion, that the elements of mind have had an important place in the process and have materially influenced the results.

The evidence for organic evolution, it is well known, is derived from three sources: First, the spontaneous variations from uniformity of structure, frequently observed in plants and animals; second, the regular succession of forms displayed in the history of life, taught by the science of paleontology; third, the recapitulation of the same succession, more or less completely, in the embryonic histories of organic beings. As time passes on, the evidence of the origin of species and the groups into which they fall by modification during descent from preëxistent forms becomes more and more perfect.

The problems presented by the preceding facts for solution may be embraced under two heads: (1) how are the variations or changes in individuals produced? and (2) when produced, are they inherited and so accumulated, or not?

The question as to the cause of variation is difficult of solution. The attempt to solve it must be preceded by a knowledge of what the lines of variation which constitute evolution have been. These are presented by the study of the life of past geologic ages. From this source we learn that there has been a successive improvement in the mechanisms of organic beings. Since the mechanisms are constructed of always plastic, and for a time growing, material, it looks probable that they have been produced by the movements of the organism itself. This suspicion is made a certainty when we learn that new mechanisms are readily constructed by organic beings, to take the place of their normal ones which have been injured or lost. The annals of surgery and of orthopedic hospitals are full of such cases, and the lower animals are still more capable of producing new structures to take the place of old ones than is man. I do not mean by this the reproduction of lost parts, as in the case of the crab and its pincer; but I mean the construction of a new joint or segment in a new place, which is obviously moulded by the mechanical action of the parts.

The movements of animals have led their progressive evolution, and a great many structures have been modified in consequence in ways which are indirect, and whose characters do not always betray their real efficient cause without full investigation. *Per contra*, the absence of motion has resulted in degeneracy and retrogressive evolution. This is amply demonstrated by the results of parasitism. Parasites are always degenerate. This is the

* Abstract of a lecture by Professor E. D. Cope given at the opening of the *Conference of Evolutionists* at Greenacre-on-the-Piscataqua on July 6th and reported in the *Boston Transcript*.

doctrine of use and disuse of Lamarck, precisely defined and demonstrated.

The cause of the movements of organic beings are various. The best known are conscious states, as hunger, cold, heat, and various other sensations; some of them of higher mental grade, as fear, anger, etc. Movements by the lowest animals, as that drop of jelly, the amœba, appear to be the result of sensations, but owing to the simplicity of the structure, it is easy to doubt that this can be the case. It is, however, impossible at present to assign any other cause to some of the movements even of the amœba, although it must be admitted that our knowledge is slight. The phenomenon of heliotropism, for instance, when these simple creatures leave the dark and crowd into light places, cannot be shown to be due to chemical or physical causes only. They seek oxygen, which is more abundant where sunlight penetrates, but they have to be aware that they need it, and must have some knowledge of the fact when when they get it. This indicates a low grade of consciousness. But it is consciousness, nevertheless. But whatever may be the state of the case with the amœba, we do not have to ascend far above it in the zoölogical scale before we meet with clear evidences of the presence of sensation. Hunger, for instance, is a form of consciousness, although it is due to a physical condition.

The result of progressive evolution in animals is developed mechanism of motion, which enables an animal to change or make its environment; and improved intelligence, which serves as a guide in all the contingencies of life. The result of retrograde evolution is the reverse of this. It is probable that no progressive evolution could have taken place without the presence of sensation. As an illustration of retrogressive evolution on a grand scale, we have the vegetable kingdom. Originally freely moving amœbas, the ancestors of plants became sessile or earth parasites. The result is that they have become bound to their environment, which they cannot change. They have therefore to suffer enormous destruction. To counteract this they have developed equally enormous powers of reproduction. In fact, although the vegetable kingdom is essential to the existence of the animal kingdom, for itself it has accomplished progress in but one direction, that of reproduction.

The contrast presented by the animal kingdom is great, and as the result has been man it is evident that the process has been as a whole progressive. The element of sensation at the bottom of it has been probably the central directive point, like the live bud on the apex of a tree. Though of limited local distribution, it has led the way, and all other modifications have followed.

The other problem for solution to which I have referred is that of inheritance. The inheritance not only of the characters of species, but of individual and family traits, is commonly accepted as a fact. But many things are not inherited, such as injuries to the organism, except in very exceptional cases, so that it has been questioned whether any character acquired by the organism during its life can be inherited. But so far as regards certain characters already referred to as having been acquired by movements of the parts, it is clearly proved that they are inherited, as they are found in the embryo before birth, and were therefore inherited by the offspring directly from the parents and were not produced by themselves. It is evident that the characters of the vertebrate skeleton were acquired through motion, or use, by gradual accretions of modifications, and that these modifications were inherited by the successive generations. Each generation added its quota to the result, which thus steadily pro-

gressed to completion. This was reached when the structures fully met the stresses and impacts, which became therefore too feeble to be further effective.

We have here then demonstrated the effect of known agencies in the production of variations. These are not the only ones which are active. The effects of light, temperature and humidity have been studied and the results noted, and it is evident that such effects have been also inherited. Evolution under the influence of such causes I have called physiogenesis, while that which results from the mechanical effects of motions I have termed kinetogenesis. The results of these processes have been submitted to the tribunal of natural selection, and the best have survived. As the direct mechanical effects of use are, however, the best obtainable under the circumstances, it is evident the natural selection in a good many cases has to do only with the struggle between the widely different types of life which are associated together in a given fauna or flora, and not so much between the individuals of each species.

The energy of progressive organic evolution is thus excluded from the domain of chance, by the transmission of all kinds of stimuli through a medium of consciousness, which has its distinctive effect on the response.

PHILOSOPHY IN THE GERMAN UNIVERSITIES.

A BRIEF summary of the lectures announced for the summer semester at the German universities may serve to show the the present status of philosophy in these institutions. The lectures here enumerated include only those offered by the philosophical faculties. No attempt is made to mention all the names familiar to American readers, but merely the most important.

The summary is as follows:

Berlin. Professor Paulsen—History of Modern Philosophy with reference to the general development of modern civilization; Psychology as the basis for all the special philosophical sciences; Ueber das Akademische Studium; seminar, Kant's *Critic of Pure Reason*. Professor Stumpf—Logic and Theory of Knowledge; seminar, Theoretical and Experimental Psychology. Professor Dilthey—History of Philosophy; seminar, History of Modern Philosophy. Other courses: History of Philosophy; History of 19th Century Philosophy; History of Ethics; History of Æsthetics; Neoplatonism; Elementary Questions in Philosophy; Psychology with demonstrations; Social Psychology; Philosophy of Religion; Practical Morals; Æsthetics; Pedagogy.

Leipzig. Prof. Wundt—Psychology; Psychological Laboratory. Prof. Volkelt—Kant's Philosophy; History of Pedagogy from the Renaissance; in seminar, Aesthetics of the Lyric. Other courses: Introduction to Philosophy and Logic; Chief Problems of Philosophy; Selected Questions in Metaphysics; Psychology of Hearing; Pedagogy; Seminar on Ethical Questions and Theory of Knowledge based on Locke's Essay; *Lectüre*, Kant's *Prolegomena*.

Halle. Prof. Erdmann—Psychology; Elements of Physiological Psychology; History of Pedagogy from the beginning of the 18th century; seminar, Kant's *Critic of Pure Reason*. Prof. Vaihinger—Introduction to Philosophy; Logic; in seminar, Pedagogical Psychology, with special notice of Herbart's pedagogical writings. Other courses: History of Philosophy; Philosophy since Hegel; Logic; Limits of Human Knowledge; Recent Investigations in Deductive Logic; Ethics; Pedagogy; Seminar on Aristotle's '*De anima*' and Mill's *Logic*.

Jena. Prof. Liebmann—Metaphysics; History of Ancient Philosophy. Prof. Eucken—History of Philosophy since Kant; Philosophy of Religion; Introduction to Philosophy; Philosophical Terminology.

Other courses: History of Philosophy from the Renaissance to Kant; Elements of Psychology; Empirical Psychology; Logic; Pedagogy, with special reference to Herbart.

Strassburg. Prof. Windelband—Logic; Philosophy of Religion; in seminar, Leibnitz's '*Nouveaux Essais.*' Professor Ziegler—History of Ancient and Mediæval Philosophy; Schleiermacher's Life, Philosophy and Theology; seminar, Herbart's '*Einleitung in die Philosophie.*' Other courses: History of Philosophy from the Renaissance; Carlyle.

Göttingen. Professor Müller—Philosophy of Nature; Laboratory for Experimental Psychology. Professor Baumann—Elements of Moral Philosophy; in seminar, Plato's '*Symposium.*' Other courses: History of Philosophy; Kant's Critical Philosophy; Philosophy of Religion (two courses); Pedagogy.

Freiburg im B. Professor Riehl—Problems of Philosophy; Intellectual Life of today and its Chief Tendencies; seminar, Kant's *Critic of Pure Reason.* Other courses; History of Philosophy from the Renaissance to Kant; in seminar, Spinoza's *Ethics.*

Munich. Professor Lipps—Aesthetics; Psychological Questions of the day; in seminar, Psychology. Other courses: History of Modern Philosophy; Psychology; in seminar, Kant's *Critic of Pure Reason.*

Tübingen. Professor Sigwart—History of Modern Philosophy; Ends and Methods of the Philosophical Sciences. Other courses: Introduction to Philosophy and Logic; Psychology; Significance of Philosophy for the Science and Culture of our Time; Fundamental Questions of the Philosophy of Religion; seminar, Kant's *Critic of Pure Reason.*

Erlangen. Professor Falckenberg—Logic and Introduction to Philosophy; seminar, Kant's *Prolegomena.* Other courses: Theory of Knowledge and Metaphysics; Philosophy of Religion; Anthropology.

Greifswald. Professor Schuppe—Psychology; Philosophy of Law; seminar, History of Philosophy. Professor Rehmke—Ethics and Pedagogy; Philosophy of Religion; in seminar, Logic.

Heidelberg. Professor Fischer—History of Greek Philosophy; Critical discussion of Gœthe's *Faust.* Other courses: Kant's Theory of Knowledge; Psychology in Relation to Theology, Jurisprudence and Philology; Anthropology; Pedagogy.

Breslau. Prof. Ebbinghaus—Logic and Theory of Knowledge; Kant's Philosophy; Laboratory for Experimental Psychology. Other courses: Introduction to Philosophy; Logic; Aristotle's Philosophy and History of its Influence.

Giessen. Prof. Siebeck—History of Philosophy to Kant; Descartes' '*Meditationes;*' seminar for advanced students. Other courses: Philosophy of the Present Time (including Psychology in England and France); Logic; Pedagogy; Schiller's Philosophical Poems.

Marburg. Prof. Natorp—Psychology; Philosophical Seminar. Other courses: History of Modern Philosophy; Kant's Philosophy; Ethics; Aesthetics; God in German Philosophy and Literature of the 18th Century; in seminar, Descartes, Kant's *Prolegomena.*

Kiel. Professor Deussen—History of Philosophy, first half from the first beginnings of Philosophy in India and Greece to the Christian era; Interpretations of Philosophy; Sanskrit Texts; Selections from Greek Philosophy. Other Courses: Logic; Logic and a Survey of the Sciences; Æsthetics; *Lectüre*; Rousseau.

Bonn. History of Philosophy from Kant to Hegel; Psychology; Ethics; Logic; Pedagogy; Experimental Psychology.

Königsberg—History of Greek and Mediæval Philosophy; Logic and Metaphysics; The Immortality of the Soul.

Würzburg—History of Modern Philos-

ophy; Logic and Theory of Knowledge; Æsthetics of Music.

The tendencies shown by this summary are by no means new. It appears very clearly that logic and the theory of knowledge are absorbing much more attention than any form of speculative metaphysics. The rapid development and widespread interest in psychology are evidenced by the fact that in the nineteen universities mentioned there are no less than sixteen courses of lectures devoted to this subject. In many places work is also being done in laboratories and seminars. Kant's Philosophy receives very general attention. Five courses of lectures are given on his system, besides the seminary work. The historical work covers all periods, starting with Professor Deussen's investigations in old Sanskrit and Greek Philosophy and extending to the philosophy of to-day.

Chas. H. Judd.

Leipzig.

CURRENT NOTES ON ANTHROPOLOGY (XI.).

THE GERMAN ANTHROPOLOGICAL ASSOCIATION, 1894.

The full proceedings of the meeting of this Association, held last August at Innsbruck, have recently been published in the *Mittheilungen* of the Anthropological Society of Vienna.

The topics discussed were largely of local interest, such as the somatology and prehistory of Tyrol, the prehistoric monuments of Switzerland, the construction of the German house and the recent archæologic finds in central Europe. Of wider scope was the address of the honorary president, Dr. Virchow, who tackled the questions of the origin of man and of the races of men; of Dr. Palacky, of Prague, who filed a brief in defence of the Biblical chronology; of Dr. Virchow again, who delivered a most instructive address on the pygmy races of the world and the phenomenon of dwarfness generally; of Professor Sergi, of Rome, on the same subject, especially the pygmies of Europe; of Professor Ranke, on the dependence of the erect staure on the development of the brain; of Dr. Mies, of Cologne, on the relations of the weight of the brain to growth; and a very learned and able summary by the president, Baron von Andrian, on 'Some results of modern ethnology.'

This was the twenty-fifth meeting of the Association, and the comparisons drawn by Dr. Virchow between the present state of anthropologic science and what it was a quarter of a century ago were instructive and entertaining,

AMERICAN SUBJECTS AT THE GERMAN ANTHROPOLOGICAL ASSOCIATION.

Naturally enough, America did not come in for a large share of attention at the German Association; but is was not wholly overlooked. Mr. Reber compared the cup-shaped markings on certain rocks in Switzerland with similar specimens in America; but he was sharply set to right by Dr. Von Den Steinen, the celebrated explorer of Brazil, with the remark: "I pointedly warn against any such supposition. All attempts to throw ethnographic bridges between the Old and New Worlds have hitherto completely failed." Dr. Von Luschan, however, referred to the modern Tyrolese feather work as having been introduced from Mexico; though that was of course quite a recent bridge. Dr. Palacky, in his paper above named, denied that there is any parallel in time or character between the ice age in America and Europe; but offered no clear reasons for saying so. Dr. Virchow, in discussing dwarf races, spoke of some very small (Nannocephalic) skulls from southern Venezuela and Columbia, but did not assert that they indicated a pygmy tribe there resident, as his argument

rather was that the cerebral capacity does not necessarily prove that the person who carried the skull was of extremely low stature. In fact, up to the present time, though individual dwarfs are known to have existed in America, and are even said to have been artificially cultivated in Mexico for the amusements of the nobles (!), no dwarf tribe has yet been discovered.

AMERICAN OBJECTS IN NEPHRITE.

THE proceedings of the Berlin Anthropological Society for January last contain a description by the well known archæologist, Dr. A. Ernst, of Caraccas, Venezuela, of three nephrite axes from that region, one of them found by himself. All three are of rather clear, green color, not presenting the milkiness of the so-called Chinese article—A trait which characterizes the specimen from the same locality which has long been in the Museum of Berlin, and which particularly attracted the attention of the late Dr. Heinrich Fischer, and which he dwells on as important in his classical work, 'Nephrit und Jadeit' (pp. 7, 347).

It is true that up to date we do not know the deposit from which these South American species were taken, but it seems a long way to go to look for it in Burmah or Turkestan, as some would advise. Mineralogists are now of the opinion that neither the coloring nor the chemical composition of these allied minerals is sufficient to designate their source. A better criterion is their microscopic structure. This presents marked and peculiar differences, and if the American specimens could not be traced to any known site on this continent, and presented all the lithological traits of the Asiatic article (which they do not, in as far as examination has proceeded), then there would be some basis for such speculations.

D. G. BRINTON.

UNIVERSITY OF PENNSYLVANIA.

PHYSICS.

LORD KELVIN AND MR. MURRAY 'ON THE TEMPERATURE VARIATION OF THE THERMAL CONDUCTIVITY OF ROCKS.'*

IN the recent interesting revival of the question of the probable 'Age of the Earth' it has developed that it would be very convenient if it were known whether rocks conduct heat more readily when hot than when cold. Not much was known on this point, and the research bearing the above title was carried out with a view to determining whether conductivity varied with temperature, and if so whether directly or indirectly. In a general way, the plan of the experiment was to produce a steady flux of heat between the two ends of a column of the rock under examination, the temperature of these ends being kept constant, and then to measure the temperature at three points within the column arranged in a line coincident with the flux line. The ratio of the mean conductivities for the portions of the rock between the first and second points and the second and third would then be defined by Fourier's theory of conductivity, as a function of the steady temperature at these points and the distance between them.

The columns of rock were not large, being generally about three or four centimetres square and six or eight centimetres high, although somewhat larger in one or two cases. They were split in halves in a vertical plane parallel to the flux line, to allow of the introduction along the centre line of thermo-electric junctions consisting of platinoid and copper. These were of wire fitted in small grooves, and the two parts were then pressed tightly together so as to resemble an unbroken column as nearly as possible. The lower end was kept at a nearly constant high temperature by means of a bath of molten tin. The upper surface was covered with mercury into which the

*A paper read before the Royal Society on May 30.

heat flowed easily, being carried off by a quantity of cold water resting on it, the water being continually renewed so as to maintain at this end nearly a constant low temperature. The difference of temperature between the two faces was about 200° C. The most successful experiments were made on slate and granite. Each experiment lasted about two hours, and after the first hour the temperature of the three thermo-electric junctions remained sensibly constant.

The results showed in both cases that the conductivity at the higher temperature was less than at the lower. The differences were very decided and such as must certainly be taken into account in all discussions of the transmission of heat by conduction in hot bodies. The work is very important and should be, as it doubtless will be, extended to greater variety of material and wider range of temperature.

T. C. M.

SCIENTIFIC NOTES AND NEWS.

PITHECANTHROPUS ERECTUS.

Mr. Arthur Keith contributes to the July number of *Science Progress* a careful account of human fossil remains; he summarizes his conclusions as follows:

"Our human geological record stretches as yet back only to an early post-tertiary period.[1] The millions of men that must have lived in these early times are known to us by only four specimens complete enough to permit of their reconstruction. But, taking these as samples of their race, we can say with some assurance that man has not changed much since the Tertiary period of the earth's history closed. The majority of men were distinctly and considerably smaller-brained than the great majority of the men that now people the earth's surface. Their faces, jaws, teeth and muscular ridges were more pronounced. Since Tertiary times the human structural progress has lain in an increase of brain and a diminution in the masticatory and alimentary systems. In these features we may suppose that early Quaternary man approached the primate ancestors of the race; in these features he certainly comes nearer the present simian type. But, for the purpose of giving us a clue to the human line of descent, the fossil remains at present known assist us not one single jot. Their configuration is quite conformable to the theory of a common descent; they bear out the truth of that theory. They also show us that man since the Tertiary period has changed structurally very little. There is nothing remarkable in this, for allied primitive forms (*Paleopithecus sivalenses*[1] and *Dryopithecus*[2]) demonstrate to us that, since the Miocene period, the anthropoid type has changed but slightly. We need not then be surprised at being obliged to seek deep within the Tertiary formations the evidences of human descent."

A PROPOSED COUNTY PARK SYSTEM.

At a recent meeting of the Natural Science Association of Staten Island, Mr. Walter C. Kerr, President of the Association, read a paper on 'A proposed County Park System.' Mr. Kerr urged the desirability of putting into execution, before it is too late, some plan to preserve what still remains of the dense forests which covered the island in earlier times. He does not consider it feasible to establish at once a series of parks with the attendant expenses of immediate improvements, but simply "the purchase by the county, at reasonable prices, of various tracts to be held as public land, and eventually, when the county becomes more densely populated, to become a park system joined by county roads. The larger and more distant tracts, however, would possess, as the years go by, an interest far greater than any conventional park could yield, for with the extensive flora of

this island, including 1,320 plants out of about 1,800 in the whole State, a little care and skill would soon convert these areas into botanical museums without destroying their rugged wildness. In this respect a word may not be amiss concerning the advanced and most practical ideas of what should constitute a park. The days of gravel walks, iron benches and notices to 'keep off the grass' have passed, while landscape gardening has in the hands of masters of the art become largely the preservation of nature rather than supplanting it with forced growths. Asphalt drives have yielded to woodland roads, while paths wind through the valleys and between the trees instead of the trees bordering paths laid out in geometrical lines and curves. One of the oldest parks in Chicago is being modified from its conventional character and devoted to the display of native wild plants and flowers that grow or have grown within twenty-five miles of the city."

GENERAL.

STEPS are being taken toward the erection of memorials in honor of Huxley. The Dean of Westminster has signified his willingness that a tablet be placed in the Abbey. It is proposed to establish at Charing-cross Hospital Medical School, of which Mr. Huxley was a student, an annual lecture and a science scholarship and medal. It is also suggested that a statue of the deceased naturalist should be placed in the great hall of the Museum of Natural History at South Kensington, beside those of Darwin and Owen.

THE *American Naturalist* reports an address by Mr. Hedley on the faunal regions of Australia given before the Adelaide meeting of the Australian Association for the Advancement of Science. Mr. Hedley concludes that "superimposed, one above another, may be distinguished three divisions of Australian life. The earliest is the Autochthonian. Possibly this arrived from the Austro-Malayan islands in or before the Cretaceous era and spread over the whole of Australia. The next is the Euronotian. Probably this reached Tasmania from South America, not later than the Miocene epoch; many of the original inhabitants, particularly on the east coast, probably disappeared before the invaders. Thirdly, a contingent of Papuan forms seized on the Queensland coast, late in the Tertiary, and likewise largely exterminated their predecessors."

PROFESSOR SWARTZ, Baron von Müller and Professor Engelmann have been elected correspondents of the Paris Academy of Sciences.

THE Department of Agriculture has obtained from Peru samples of a giant species of maize. The size of the grains is four times as large as those of the species grown in the United States. The plant is very prolific and it is hoped that it will be possible to introduce it into America. Professor E. L. Sturtevant is making a study of this cereal, to which the name of 'Zea amylacæ' has been given, with a view to finding out how it may be cultivated most advantageously.

EXTENSIVE studies of the upper atmosphere have been planned by Professor A. McAdie, of the Weather Bureau, by the means of flying kites. Ten kites, the two leaders measuring six feet high by seven wide and eight others following five feet high by six feet wide, will be flown, if possible, to the hight of two miles. It is hoped, by the means of these experiments and others which will follow them, to make possible the drawing of a map of the atmosphere in which temperature and barometric curves, electric currents, etc., will be located for various parts of the country and for different seasons of the year. The kites will be kept in the air twelve hours, if possible. In order that accurate temperature

curves may be taken, a registering thermometer will be attached near the top of line. A surveyor's transit will be used to calculate the height to which the kites ascend, the differences being worked out by triangulation.

The Third International Congress of Agriculture will be held at Brussels from September 8th to 16th.

An International Exhibition of Hygiene, organized under the direction of M. Brouardel, was opened at Paris on Thursday last. The exhibits are divided into five groups, referring respectively to (1) the hygiene of private houses; (2) city hygiene; (3) the prophylactics of zymotic diseases, demography, sanitary statistics, etc.; (4) the hygiene of childhood, including alimentary hygiene, questions of clothing and physical exercises; (5) industrial and professional hygiene.—*Nature.*

A return has been issued showing the number of experiments performed on living animals in 1894 under licenses, as required in Great Britain. The total number of persons holding licenses during the year was 185, and of these 56 performed no experiments. 3104 experiments were performed in all.

The second Italian Geographical Congress will be held in Rome during the latter part of September, 1895, the days not yet having been designated. Information concerning the Congress, which is held under the patronage of the King of Italy and promises to be one of great importance, can be obtained from the President of the committee, Via del Plebiscito 102, Rome.

The Academy of Sciences of Prague has begun the publication of a *Bulletin Internationale.*

There remains in the treasury of the city of Baltimore about $280,000 left from the fund of $1,000,000 obtained by the issue of city bonds for the purpose of completing the purchase of Clifton Park from the Johns Hopkins estate. It is proposed to use this money in the construction of a Boulevard from Druid Hill Park to Clifton Park.

Professor Sikorski, of the University of Kief, writing in the *Kievlianin* upon the psychology of the Russian people, brings forward some interesting statistics concerning the frequency of suicide in the different nations of Europe. According to these figures the death-rate from suicide per million living is in Saxony 311, in France 210, in Prussia 133, in Austria 130, in Bavaria 90, in England 66, while in Russia it is as low as 30. Further, it is found that during the last thirty years the suicide-rate has in Russia remained stationary, while in all other European countries it has increased by 30 or 40 per cent. The exact significance of figures such as these, relating to so complex a phenomenon as suicide, is not easily brought out. Few, however, will be disposed to question the assertion that much of the explanation of the low rate in Russia is to be found in the patience and long suffering of the Russian peasant under even the worst misfortunes. Among other characteristics Professor Sikorski also finds a certain indecision of character which fears to say a word or do an action which shall not admit of retreat or withdrawal. Crime is comparatively rare in Russia; thus, the number of persons tried for murder per million living in the year 1887 was in Italy 96, in Spain 55, in Austria 22, in France 14, in Russia 10, in Germany 9, and in England only 6.—*The Lancet.*

At the annual meeting of the American Institute of Electrical Engineers Professor F. B. Crocker presented a preliminary report from the committee on indexing electrical literature. The committee reported that it was very desirable for the Institute to undertake a complete index of electrical literature, and that the past, rather than

current, literature should be cared for first as being the more important. The expense of this undertaking would be from $16,000 to $30,000. The committee believed that the index should include brief notes as to the character or scope of articles, since a single line of description would save the looking up of probably seven-eighths of the possible references.

IN *The Atlantic Monthly* for August Mr. Percival Lowell concludes his series of articles on Mars treating the 'oases.' He reviews the evidence on which he finds it probable that we see the effects of local intelligence on the surface of the planet as follows: "We find, in the first place, that the broad physical conditions of the planet are not antagonistic to some form of life; secondly, that there is an apparent dearth of water upon the planet's surface, and, therefore, if beings of sufficient intelligence inhabited it, they would have to resort to irrigation to support life; thirdly, that there turns out to be a network of markings covering the disc precisely counterparting what a system of irrigation would look like; and, lastly, that there is a set of spots placed where we should expect to find the lands thus artificially fertilized, and behaving as such constructed oases should."

DR. D. W. MCGEE, lecturer in Oriental literature in Toronto University, was drowned on July 22d.

DR. ERNEST HENRI BAILLON, the well-known naturalist, died recently in Paris at the age of seventy-two. He was professor of medical botany in the School of Medicine, and of hygiene in the Central School of Arts and Manufactures. He was the author of a number of books on botanical subjects.

PROFESSOR CHARLES C. BABINGTON, professor of botany in Cambridge University, died in Cambridge on July 22d, at the age 87 years.

DR. NORTON S. TOWNSHEND, professor of agriculture in the State University of Ohio, died recently at the age of seventy-nine. He was a student of medicine and graduated in New York in 1840. In 1863 he was appointed medical inspector in the United States army, in which capacity he served until the end of the war. In 1869 he accepted the professorship of agriculture in Iowa Agriculture College, of which he was one of the founders. He resigned a year later to assist in founding the Agricultural and Mechanical College of Ohio, in which institution, now known as the University of Ohio, he held the chair of agriculture from 1873 to the time of his retirement as professor emeritus.

PROFESSOR JULIUS ZUPITZA, the celebrated philologist, died recently in Berlin at the age of 51. He held the chair of English in Berlin University for nineteen years.

UNIVERSITY AND EDUCATIONAL NEWS.

THE Board of Trustees of the City of New York have selected a site for the new College Building on Covent Hill. It consists of 127 city lots bound north by 138th street, south by 140th street, east by St. Nicholas avenue and west by Amsterdam avenue. The appropriation for the site is limited to $600,000, but it is believed that the price of this land will come within the required limits.

THE accommodation of Radcliffe College has been enlarged by the purchase of a new house.

THE trustees of the estate of the late Miss Margaret Harris have given securities valued at £14,000 and yielding about £470 to establish a chair of physics in the Dundee University College.

IT IS proposed to establish an economic museum in the University of Pennsylvania. The museum will contain samples of the products and materials of all the arts, in-

dustries and trades of productive, technical and constructive industry.

It is stated that Dr. Francis Walker has accepted a call tot he department of political and social science in Colorado College.

The University of Pennsylvania extends the right of naming one of the houses in the new dormitory to all contributors of $10,000 or more to the building fund. The following are the names of the contributors up to the present date: Charles C. Harrison, Alfred C. Harrison, Thomas F. Dolan, Robert E. Foerderer, William M. Singerly, Hugh Craig, Jr., Alice D. Craig, Hatfield, Burnham, Williams & Co., the Misses Blanchard, Thomas McKean, E. H. Fitler, J. E. Bayard, Richard F. Loper and William W. Frazier.

CORRESPONDENCE.

ABORIGINAL SANDALS.

Dear Science: In attempting to comprehend the practical part of drawings, etchings, carvings and sculptures in the mountain region of America from Mexico southward, I have often tried to get some information of the footwear. Any one who will look through the drawings of 'Kingsborough' will notice that the sandals on the feet of the different figures have soles and heelstraps looking almost like the quarters of a modern shoe or the heel of a Peruvian soldier's sandal, and that in some way a lacing passes around in front of the ankle on top of the foot. There is no intimation of a string or strap passing up between the toes as in the modern rawhide sandal, which may be seen by the thousands on the feet of peons in Latin America all the way from Arizona and New Mexico to the limits of Peru.

Wiener, in his work entitled 'Perou et Bolivie,' figures a great many styles of these modern sandals which are, in form, allied to the thousand-and-one varieties in use anywhere about the Mediterranean, and awakens a suspicion that the sandal with a single string passing between the great toe and the second toe is of Eurafrican origin.

In plate (3) of 'Stone Sculptures of Copan and Quirigua, with drawings by H. Meye and text by Julius Schmidt, published in New York in 1883 by Dodd & Mead,' there will be seen on the foot of the Monolith a sandal in which a string passes between the first and the second toe and the third and the fourth toe, forming a loop which is attached by means of a knot to an ornamental bandage encircling the ankle, and it is to this sculpture that I wish to draw special attention.

Those of my readers who were so fortunate as to visit the Cliff-dweller collections at the Columbian Exposition may recall the styles of sandals there exhibited; if not, they will please turn to 'Nordenskjold's' illustrated work on the Cliff-dwellers' collections, made by him, and examine plate (46). There two styles of sandals are figured, not very distinctly, but the characteristics can be made out.

I am indebted, however, to Mr. Stewart Culin, of Philadelphia, for the privilege of examining carefully four examples of Cliff-dwellers' sandals in possession of the Museum of the University of Pennsylvania. In three of these there is either a loop or a provision for a loop, which passes between the first and the second toe and the third and the fourth, enclosing the second and third toe. In the fourth sandal a series of loops around the margin of the sole serve to receive the lacing which passes backward and forward, across the foot diagonally through one and then another, using up the whole series. These four sandals will now be more carefully described. In one of them the binding string or lacing commences at the instep and passes in a bend around the toeloop, and by another bend around the right side of the heel-

cord, and by another bend around the left side of the heelcord and back to the starting point, where it is fastened off by a series of half-hitches. The heelcord is a twine woven into the margin of the sole on either side of the heel. This, according to Mr. Cushing, is called by the Zuñi *Égati* (heel-skin-under-grass). The sole is made of split *Yucca angustifolium* fibre plaited in the diagonal form of weaving common in the Pueblo country, each stitch passing over two and under two.

A second pair, having the eyelets worked in for the toeloop, is built upon a warp of twenty-three filaments or small bundles of shredded Yucca fibre. The weft is doubled, the upper portion consisting of a close weaving exactly like that on the Pueblo blankets and belts, the yarn being twisted bast fibre (probably Apocynum). The lower part of the sole consists of a series of rows or twined weaving laid under and enclosed in the warp of the upper weaving, but not appearing on the upper side. The exact technique of this under weaving has not been made out, owing to the danger of mutilating the specimen, but it seems to be in a line with the composite texture noticed in the Yoki baskets which I have described elsewhere. This sandal, when new, was prettily decorated with bands and stripes of red and black threads, alternating with the natural color of the material. At the heel and toe the warp threads are braided down and enclosed in an ornamental border of plaited buckskin thong. The toestrap is missing and the heelstrap is a small rope of bast fibre. One end firmly secured, the other slips through a loop on the back and is used as a part of the lacing.

The third specimen is built up upon four warp ropes of shredded Yucca fibre; the weft being of short pieces of very loosely twisted yarn of Yucca fibre woven into the warp by the same style of weaving as in the last named, such as is seen on the blankets and the Moki wicker trays and in the ordinary twilled goods. These short warp strands are so manipulated that the frayed ends shall be spread out on the top of the sandal. The four-stranded warp, the plan of weaving and the shredding of the ends, are precisely like the texture of many hundreds of Japanese and Corean sandals, only in this specimen the shredding forms the top of the sandal, while in the Japanese example of straw the shredding forms the bottom. The loop for the toes in this specimen is well shown, consisting of a bit of four-ply rope of the Agave fibre, loosely twisted. The lacing is gone.

The fourth example is a very coarse sole of split Yucca fibre plaited diagonally and plainly with loops of the same material around the margin for the lacing, and on top between the sole and the lacing is laid a pad or bed of neatly folded corn husks to act as a protection to the sole of the foot.

In the National Museum is a sandal woven in the same manner as the one last described, having a loop to enclose the second and the third toe. This specimen was dug from the celebrated mound in Saint Georges, Utah, by Edward Palmer.

If one will examine a collection of photographs showing the peon and common people of Mexico and other Latin American states by the Rev. F. H. Cleveland, he will notice that many are wearing sandals having no string between the toes whatever.

In the sculpture from 'Copan' and the mound at Saint Georges, we have the two ends of a geographic era in which the sandal has a loop in front enclosing two toes.

The questions raised by these specimens are as follows: Was the old aboriginal Mexican sandal provided with a loop to enclose the second and the third toe? Is the form of rawhide sandal, now so common in Latin America, having a single string between the first and the second toe, a derivative from the Old World?

The sandal with the loops around the edges may be compared with a specimen figured in 'Wiener's Peru,' made of hide fitted around the foot and slashed around the border to receive the lacing.

It may be also compared with sandals of vegetal material in collections from northern Japan and the Aino country.

Yours truly, O. T. Mason.

U. S. National Museum.

THE PIGNUTS.

There is some question as to the exact distribution of the common Pignut (*Carya porcina* or *Hicoria glabra*) and the related *Carya* or *Hicoria microcarpa*, and the undersigned will be grateful for herbarium specimens, and especially nuts with their husks, representing both. In the recently published seventh volume of Professor Sargent's Silva, the range of *glabra* is given as southern Maine to southern Ontario, through southern Michigan to southeastern Nebraska, southward to the shores of the Indian River and Peace Creek in Florida, and to southern Alabama and Mississippi, through Missouri and Arkansas to eastern Kansas and the Indian Territory, and to the valley of the Nueces River in Texas. *H. microcarpa* (treated in the Silva as a variety of *glabra*, under the varietal name *odorata*) is said to occur in eastern Massachusetts, Connecticut, eastern and central New York, eastern Pennsylvania, Delaware, the District of Columbia, central Michigan, southern Indiana and Illinois, and Missouri. William Trelease.

St. Louis, Mo.

SCIENTIFIC LITERATURE.

A Students' Text-book of Botany: By Sidney H. Vines, Sherardian Professor of Botany in the University of Oxford. First half pp. x., 1–430, Fig. 279. 1894. Second half pp. xvi., 431–821. 1895. London, Swan, Sonnenschein & Co. New York, Macmillan & Co. 8vo.

The completion of this, the best general text-book of botanical science yet published in any language, and just now the only adequate presentation in compact form of the subject-matter within its scope, is an event of more than ordinary interest in the annals of book-making. It is not too much to say that in this work Dr. Vines has surpassed even the high expectations of his friends. The volumes in hand have all the admirable literary quality and firm grasp of recent research that characterized so notably the *Lectures on the Physiology of Plants* by the same author, which appeared in 1886 and immediately took its place among the leading authoritative manuals in its line. The later work gains, perhaps, over the earlier in its somewhat more concise and transparent style and in its more perfect subjection of the material to the logical classification adopted at the outset. Certainly nothing could be better than the chapters on the general morphology of the members, on the tissues and on the general physiology. It is a great gain to botanical teaching in England and America to have the modern point of view in anatomy and physiology thus brought forward without the confusion and archaisms that diminished in a degree the availability of older texts in common use.

In general, it should be said that the perspective of the work is most admirable. About the right relative amount of space is given to each of the four principal subdivisions—Morphology, Anatomy, Taxonomy (here called *anglicè*, the 'Classification of plants') and Physiology. As has been pointed out by previous reviewers, it might seem that the third division has been somewhat unduly extended at the expense of the fourth. Doubtless this is a natural result of Dr. Vines having specialized in physiology, for under such conditions he would possibly desire to err rather on the side of understating than of overstating the prom-

inence of his particular field, and again, in a department of the subject where his investigations and research have been so voluminous, it might seem to him a more hopeless task than elsewhere to present more than an abstract within the limits he had decided upon.

A point of peculiar excellence in this work is the terminology. Indeed, the reviewer has but one complaint to make, and that is that a somewhat too wide implication is permitted to the term 'spore.' It would seem advisable upon theoretical as well as upon practical grounds to limit zygotes, oöspores or oösperms under another name, which should indicate their sexual origin. But the conservatism apparent in Dr. Vines' use of 'spore' in the general sense is more than atoned for by his splendid development of the Schwendener-Van Tiéghem terminology of the vascular and stelic tracts, by his masterly treatment of conjunctive and cortical tissue, by his illuminating explanation of secondary increase in thickness and in the special portion by his thorough and adequate separation of sporophytic from gametophytic terminology. This latter becomes a trifle less perfect in handling when the angiosperms are taken up, but even here, if one makes a slight mental alteration in the sequences, there is no trouble in gaining an accurate idea of the homologies. For an exactly logical presentation of life-histories, it is not clear that Dr. Vines would not have served his purposes as well by always discussing the gametophyte in detail before passing to the sporophyte. In point of fact, the gametophyte is given prior treatment until the Pteridophytes are reached, and then, in the ascending order, the sporophyte is given its handling before the gametophyte. This is, of course, in deference, perhaps unconscious, to the ancient notion that the larger or more potent in vegetation of the two alternating forms is *the plant*, while the other is to a degree subsidiary. It is not apparent that it would not on the whole have been better to give the phylogenetically older gametophyte its proper precedence in all cases from Oedogonium to Angiospermæ.

The wealth of terminology has by some unthinking reviewers been condemned as making the whole work unnecessarily technical in tone and even giving a flavor of pedantry to the whole. In reply to such criticisms, Dr. Vines might aptly point out that a certain class of botanical textbooks which inform one that the 'spores are the seeds of the fungi,' for example, follow this valuable rule of calling fundamentally different things by the same name. In such cases the terminology is simple, and so is the state of mind of the student who has followed it. Modern botany is scarcely the young person's discipline of floral delectation that it was earlier supposed to be, and it does no harm to have a clear, clean-cut, limitation of different concepts under different names.

In the taxonomic portion of the work there is a conservative tone about the angiosperm arrangement which betokens the persistence of the great influence of Robert Brown, Lindley and Bentham. This is in interesting contradistinction to the firm touch with which the author places Isoëtes in its proper place alongside of Marattia and to his modern grouping of algæ, fungi and bryophytes. It should be taken as evidence, it may be, of the timidity with which the serious student of morphology approaches the antiquated delusions of systematic botanists which, more than any other delusions of botanical science, are embalmed in sumptuous volumes, under the ægis of powerful reputations and upon the foundations of scientific officialism. The cryptogams, so-called, are recognized to be a more modern and plastic group—from the point of view of investigation. Hence, one who trusts to his own good judgment and to the van-

guard of current research when cryptogamic morphology or taxonomy is in question may lean a little on the established order when he sets foot among the angiosperms. While Dr. Vines' treatment of angiospermic taxonomy does not, on the whole, please the reviewer as well as that of Warming or Schimper or of the Engler-Prantl series, nevertheless this is a matter largely of individual opinion.

In conclusion, the Vines text-book is a remarkably strong and well-balanced work. Its peculiar excellences are in the generally modern point-of-view, the transparency of the style, the perfection of the terminology, the firm and logical grouping of the material, the compactness of the treatment—especially in the chapter on physiology—the introduction of exact morphological conceptions to take the place of vague, and the evidence of wide and painstaking research that appears upon almost every page. Students of botany are to be congratulated in the same breath with the author upon the completion of the book.

Conway MacMillan.

University of Minnesota.

Chemical Analysis of Oils, Fats, Waxes and of the Commercial Products Derived Therefrom. From the German of Professor Dr. R. Benedikt. Revised and enlarged by Dr. J. Lewkowitsch., F. I. C., F. C. S., Technical Manager at the Whitehall Soap Works, Leeds, England. Macmillan & Co., New York, publishers. Price, $7.00.

The threefold task of translating, revising and enlarging Dr. Benedikt's work 'Die Analyse der Fette und Wachsarten, 1892,' by Dr. Lewkowitsch has resulted in presenting those interested in the subject the best and most complete work on Fats, Oils and Waxes. It is rarely that one finds the work of the translator so excellently performed. Almost every page bears the evidence of additions and alterations. The little work of the first publication of Dr. Benedikt has now grown into a large volume of almost 700 pages, an evidence of the numerous researches that have been made in this subject. Much of the work that we are accustomed to see in older works is here omitted, and we find it replaced by the results of more modern thought. We cannot accuse Dr. Lewkowitsch of publishing the work from other books, for at the end of almost every chapter the writer gives his experience with the various methods proposed and advises which one should be accepted, showing that this work is the result of many years' investigation. This method is most gratifying to the chemist, for assisted by the advice of such an authority much otherwise needlessly wasted time is saved.

The chapter on Physical and Chemical Properties of Fats and Waxes is very complete. Who is it who will not be thankful to Dr. Lewkowitsch for giving us concisely the result of the many publications on the rancidity of fats? "Rancidity (says Dr. L.) must, therefore, be considered due to direct oxidation by the oxygen of the air, this action being intensified by exposure to light." The table on p. 50 giving the percentages of free fatty acids in oils and fats of vegetable origin is new and is of special interest. Some of the oils, when freshly pressed from the seed, present so small a percentage that we may assume that these fats as well as the animal fats originally exist as absolutely neutral glycerides. Almost all works on fats and oils—as does this one—assert that "Fats can be heated to 250° C without undergoing any change." This I think most men who handle fats and oils practically will be forced to deny. No matter how carefully the fat has been refined to free it from all foreign matter, after being subjected to such heat it no longer possesses its original physical properties.

Lard or tallow will assume the appearance of a soft grease.

The part of the work devoted to the Quantitative Analysis is excellently written, disclosing at once that the author is thoroughly familiar with the work. The latest researches are carefully quoted and criticised, the criticisms being usually strengthened by results obtained in his own laboratory. We refer the reader especially to Twitchell's method for the determination of Resin Acids. On p. 196 he says: "Of all the methods proposed hitherto for the estimation of resin acids in mixture with fatty acids, that recommended by Twitchell yields the best results, and should therefore be used to the exclusion of the methods described before. The results, however, must not be considered as absolutely correct; they are only approximate, as Lewkowitsch has shown by an exhaustive examination of both the volumetric and gravemetric processes." The author then gives a series of tables giving the results of this work. Dr. Lewkowitsch's assumption that the reason for the results by this process, being only approximate, is due to the action of hydrochloric acid upon the resin, has since the publication of this work been shown to be wrong. Evans and Beach in a recent publication have shown that the low results obtained by the gravemetric process is due to a large percentage of unsaponifiable matter in the resin. They found as high as 9 per cent. of unsaponifiable matter in one resin.

The Chapters IX., X., XI. and XII. are almost entirely rewritten and contain much original work. The sulphur chloride test for drying oils offers many interesting points of inquiry. In the table given on p. 228 we find that tallow and lard do not thicken with S_2 Cl_2, and that the resulting product is entirely soluble in carbon bisulphide, whereas on p. 229 we find in another table that tallow oil and lard oil (products obtained by pressure from tallow and lard) solidify with S_2 Cl_2 after 12 and 10 minutes respectively and form products not completely soluble in carbon bisulphide. In summing up the results of the various investigations on 'Color Reactions,' Dr. Lewkowitsch said that the results on all color reactions should be taken with the greatest caution and mention should be made that the test for cotton seed oil with nitric acid which the author so forcibly recommends be included. The descriptions of the various oils, fats and waxes are very complete. The part given to cotton seed oil is especially so. In this one description we find twenty-three different publications referred to, including articles from American, English, German, French and Italian journals.

We are very sorry to find Dr. Lewkowitsch follows the footsteps of so many European chemists, decrying everything foreign. We should be pleased to know his authority for the following: (p. 460) 'in America adulteration has become an openly acknowledged practice,' etc. It simply points out to the American reader the customary ignorance of foreigners regarding our laws on the subject of adulteration. In Chapter XII., devoted to Technical and Commerical Analysis, lard and lard substitutes are dismissed with two and one-half lines. It is upon this very subject that a well directed system of investigations is necessary, and to judge by the numerous cases of supposed adulterations at all times before the English courts, Dr. Lewkowitsch's works would be considered the better for it, and must be considered incomplete for the lack of it.

JOSEPH P. GRABFIELD.

CHICAGO, July 6, 1895.

SCIENTIFIC JOURNALS.

AMERICAN JOURNAL OF SCIENCE.

THE August number of the *American Journal of Science* opens with an article by

Frank H. Bigelow upon the 'Earth as a Magnetic Shell.' This is an investigation, largely theoretical, upon lines already followed by the author in earlier publications. In discussing the modes of transference of energy from the sun to the earth, he assumes, in addition to the electro-magnetic radiation emanating from the sun in all directions in straight lines, also a magnetic radiation belonging to the 'magnetic field,' which near to the earth is at right angles to the ecliptic. In this magnetic radiation are found the explanation of several sets of phenomena, as the aurora, magnetic disturbances, earth currents and meteorological periodic variations. This subject is discussed at length with the aid of a number of diagrams. The author concludes from the values obtained for the vectors of the polar magnetic field at the earth that there is an *exflected* system around the poles and an *inflected* system in the tropical belts. Further, he shows that the outer stratum, or shell, of the earth is permeable to external magnetic forces, while the nucleus is is not; assuming that $\mu = 2$, the radius of the nucleus is calculated to be 3170 miles. The effect of the magnetic radiation argued for is discussed with reference to the several sets of phenomena mentioned, and it is also suggested that certain deviations from the Newtonian law of gravitation noted in the secular motions of the sun and the planets may find their explanation in a mechanical stress called out by this 'magnetic radiation.' Another physical article is by J. Trowbridge and W. Duane, who continue their discussion of the results obtained in the Jefferson Physical Laboratory in the experimental determination of the velocity of electric waves. The essential features of the methods employed have been earlier (April, 1895) described, but they are here improved upon. The final result for the velocity obtained is 3.0024×10^{10}, and the conclusion is reached that the velocity of short electric waves traveling along two parallel wires differs from the velocity of light by less than two per cent. L. A. Bauer takes up anew the discussion of the distribution and secular variation of terrestrial magnetism—a subject treated by him in the thesis noticed in Science, Vol. I., No. 25—and reaches some important results to be extended in a following article; they may be more definitely spoken of later in connection with this. Two articles upon analytical chemistry come from the laboratory of F. A. Gooch at New Haven; the first, by Gooch and Phelps, is a discussion of a new method of determining carbon dioxide; the second, by Kreider, describes some new devices (as a hot filter, a valve, etc.) convenient in the laboratory. In the department of mineralogy, W. M. Foote describes leadhillite pseudomorphs from Granby, Mo.; W. H. Hobbs describes cerussite crystals from Missoula, Montana, barite and manganite from Negaunee, Michigan, chloritoid from Michigamme, Mich.; W. F. Hillebrand gives analyses of calaverite from Cripple Creek, Colorado. In petrology, L. V. Pirsson discusses the subject of complementary rocks and radial dikes. In the department of botany, B. L. Robinson and J. M. Greenman present a long article (42 pages, forming contribution No. IX., N. S.), from the Gray Herbarium, and containing descriptions of many new species. This consists of four parts, viz.: I. On the Flora of the Galápagos Islands, as shown by the collection of Dr. G. Baur; II. New and Noteworthy Plants, chiefly from Oaxaca, collected by Messrs. C. G. Pringle, L. C. Smith and E. W. Nelson; III. A Synoptic Revision of the Genus Lamourouxia; IV. Miscellaneous New Species. The number (108 pages) concludes with a notice of Professor Thomas H. Huxley by O. C. Marsh, and likewise one of Professor Daniel C. Eaton by W. H. Brewer.